Item #24

Town of Mountain Village

Date: 7/11/19

To: Town Council

From: Finn Kjome Public Works Director

Re: Reduction of Copper in the Drinking Water System

Overview:

This pilot program is a direct result of the of the combined efforts of the users of the Regional Sewer Treatment Facility's attempt to meet the copper limits required by their discharge permit with the State. I want to make it known the drinking water in the Mountain Village does not have elevated copper levels and that the copper in the water is well below the maximum limits set by the State. The Mountain Village is a source of copper at the sewer treatment plant therefore the Town needs to be part of the solution. Several experts have looked at removing copper at the sewer plant but have determined that it is best to treat for copper before it gets to the plant.

Over the last year working with Russell Engineering and Allen Plummer Associates it has been determined that adding an orthophosphate/polyphosphate blend will provide the best results with the Towns drinking water. A request to change the treatment of the Mountain Village's water was applied for with CDPHE in April. The Colorado state approval permit is attached below.

Public Works is requesting a motion in favor of running the pilot test starting as soon as possible to start collecting data. It will be necessary to be in full compliance with the treatment plants discharge permit by the end of 2019 to avoid any potential violation with the state.

FK

TECHNICAL MEMORANDUM

TOWN OF MOUNTAIN VILLAGE WATER SYSTEM

PILOT RECOMMENDATION FOR THE REDUCTION OF COPPER IN THE DRINKING WATER SYSTEM

April 2019

TOWN OF MOUNTAIN VILLAGE

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

PREPARED FOR	Colorado Department of Public Health & Environment
PREPARED BY	Julian Paiz
REVIEWED BY	Mark Dahm, PE
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PROJECT NO.	RPE-0274

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1. INTRODUCTION

The purpose of this Technical Memorandum is to present the results of an assessment of the Town of Mountain Village (District) water supply system focused on evaluation of the technical feasibility of feeding an orthophosphate/polyphosphate blend to reduce the concentration of copper in the drinking water system. This TM is intended to supplement the Basis of Design Report to which this document is attached. Wastewater generated in portions of the Mountain Village development flows to the Town of Telluride wastewater treatment plant (WWTP). This portion of Mountain Village wastewater originates as from The Districts water system. While the water system is currently deemed to have Optimal Corrosion Control Treatment in place with both lead and copper levels below the CDPHE action level, measurable concentrations of copper are being transmitted to the WWTP. The facility has intermittent difficulty meeting the copper limit required by their discharge permit. Mountain Village requested that Alan Plummer Associates, Inc. (APAI), under subcontract to Russell Planning and Engineering, complete an evaluation of whether orthophosphate addition would be an effective approach to reduce the concentration of copper in the Mountain Village sewage collection system effluent. As a result of its direct applicability, the EPA guidance manual for OCCT was used as a template for this analysis and the proposed pilot project is is consistent with the recommendations outlined in the EPA manual.

The District water system includes a number of wells and storage tanks with disinfection treatment using sodium hypochlorite chemical feed systems. Samples from five locations used by Mountain Village for Lead and Copper Rule (LCR) compliance sampling required by the Colorado Department of Public Health and Environment Regulation No. 11, were sampled multiple times during the months of May through August 2018, with samples analyzed for a list of water quality analytes useful for evaluating corrosion indices and potential for carbonate precipitation. A number of additional locations were sampled as part of required LCR sample schedules in August 2018. This memorandum presents the following items:

- Overview of the USEPA Lead and Copper Corrosion Control Program
- Water Quality Parameter Summary
- Proposed Pilot Project
- Concluding Remarks

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ATTACHMENTS

2. OCCT RELEVANCY TO THE MOUNTAIN VILLAGE COPPER REDUCTION ASSESSMENT

The Lead and Copper Rule requirements are described fully in CDPHE Regulation No. 11 (adopted from the USEPA Lead and Copper Rule requirements). Water system suppliers are required to collect lead and copper tap samples at locations prescribed in the regulation and under a scheduling frequency that is tied to the size and category type of water system. The intent of the regulation is to identify exceedances of the lead and copper standards and to standardize corrective action approaches that are effective in reducing water distribution system corrosion potential by making specified improvements to water treatment systems.

2.1. USEPA OPTIMAL CORROSION CONTROL TREATMENT (OCCT) DOCUMENT

USEPA developed an Optimal Corrosion Control Treatment Technical Recommendations for Primacy Agencies and Public Water Systems document (OCCT), USEPA, March 2016 for use in evaluating water system lead and copper corrosion control performance. This document contains information concerning:

- Water quality factors affecting the release of lead and copper, including: pH, alkalinity, and dissolved inorganic carbon (DIC); corrosion inhibitors; hardness; buffer intensity (alkalinity); dissolved oxygen/ORP; water temperature; water use; and other factors.
- Corrosion control treatment methods: pH/Alkalinity/DIC Adjustment; phosphate inhibitors; silicate inhibitors;
- Technical recommendations for selecting treatment alternatives feasibility/cost: reviewing water quality data; evaluating the potential for scaling; identifying possible limitation for treatment options; target dose and water quality; pH/alkalinity/DIC adjustment; phosphate-based inhibitors; silicate inhibitors.

2.2. APPLICATION OF THE OCCT ASSESSMENT FRAMEWORK TO MOUNTAIN VILLAGE COPPER REDUCTION

Since the technical issues concerning copper reduction in the District water supply are essentially the same as those covered in the OCCT, the evaluation of options presented in this TM follow the approaches recommended in the OCCT. The predominant mechanism for the release of copper in potable water systems is through corrosion induced release of copper from service and residence piping, and copper and brass fittings and fixtures. The assessment and treatment framework set forth in the USEPA OCCT provide a recommended approach to implementing water treatment system modifications to attain a reduction in copper concentrations by reducing copper corrosion mechanisms.

Ongoing sampling and reporting of District tap water lead and copper concentrations indicate no exceedances of the LCR required lead and copper concentrations. However, copper concentrations at some of the sample locations and at some sample collection intervals while below LCR requirements may be present at concentrations that contribute to the copper loading to the Town of Telluride WWTP.

While the OCCT recommendations are directed at reducing copper concentrations to the LCR copper limit of 1.5 mg/L and the concentrations present in Mountain Village tap samples are significantly lower, generally less than 0.5 mg/L at a maximum, assessment of the Mountain Village water system consistent with the OCCT framework is believed to be the best approach to attain additional incremental reductions in tap water copper concentrations.

3. SUMMARY OF WATER QUALITY DATA AND EVALUATION OF CARBONATE PRECIPITATION POTENTIAL

Samples were obtained from five (5) out of the twenty (20) total Mountain Village LCR sampling locations in five sample collection events during the period May through August 2018. Samples were analyzed for the following water quality corrosion control analytes: alkalinity, calcium, chloride, copper, hardness, iron, lead, magnesium, manganese, pH, TDS, and sulfate; with the results summarized in Table 1, below. Total alkalinity ranges between 71 and 86 mg/L as CaCO3, hardness ranges between 158 and 208 mg/L as $CaCO_3$, TDS ranges between 195 and 294 mg/L, and pH ranges between 7.52 and 7.99. Water is typically identified as high hardness with values exceeding 150 mg/L as $CaCO_3$.

Table 1. Water Quality Summary

Parameter	Units	Min.	Max.	Avg.	St. Dev	Count
Alkalinity, Bicarbonate as CaCO3	mg/L	71	86	79	4.8	15
Alkalinity, Total as $CaCO_3$	mg/L	71	86	79	4.8	15
Calcium	mg/L	55	72	65	6.2	15
Chloride	mg/L	2.4	3.2	2.75	0.239	15
Copper	mg/L	0.0096	0.38	0.112	0.090	82
Hardness as $CaCO_3$	mg/L	158	208	187	15.4	15
Iron	mg/L	0.00051	0.0964	0.012	0.020	33
Magnesium	mg/L	4.75	6.79	5.54	0.653	15
Manganese, Total	mg/L	0.0053	0.0053	0.0053		1
pH	s.u.	7.39	7.99	7.73	0.149	15
Solids, Dissolved	mg/L	195	294	259	29.4	20
Sulfate	mg/L	85	135	119	15.7	15

Attachment 1 to this TM presents a table containing the laboratory results of the water quality corrosion control parameter testing. Attachment 2 contains the laboratory data sheets for this sampling.

3.1. WATER STABILITY CALCULATIONS AND ASSESMENT OF CALCIUM CARBONATE FORMATION POTENTIAL

Water stability calculations modeling was performed for the analytical results summarized above using the American Water Works Association Tetra Tech Model for Water Chemistry, Process, and Corrosion Control (AWWA 2017). Tabulations of the Langelier Saturation Index (LSI), Ryznar Stability Index (RSI), Dissolved Inorganic Carbon (DIC), and Calcium Carbonate Precipitation Potential (CCPP) are included in Attachment 3.

3.1.1. DISTRICT TAP WATER LSI, RSI, DIC, AND CCPP RESULTS

Water model input parameters and model outputs at two temperatures 5 °C and 20 °C are presented in a Technical Memorandum developed by APAI included as Attachment 3 (refer to Table #2 in Attachment 3). The LSI and RSI provide information concerning the calcium carbonate scale forming tendency of the water, and were found to indicate that the District tap water is slightly corrosive especially at the lower temperature. The calculated LSI ranged from -0.39 to 0.42. LSI values greater than -1.0 and less than -0.25 are classified as slightly corrosive, and an LSI greater than -0.25 is classified as non-corrosive. The calculated RSI ranges from 7.14 to 8.29. Waters with RSI values between 7 and 8.5 are classified as slightly corrosive, and an RSI less than 7 is classified as non-corrosive.

DIC was calculated in the range of 20 to 21.1 mg/L as C, which indicates dissolved carbonate species at levels that can potentially contribute to carbonate scaling dependent upon treatment technology selections.

The CCPP was calculated to range from -6.89 to 5.15 mg/L as $CaCO_3$ and provides an estimate of the amount of calcium carbonate that can be expected to precipitate based on the system conditions. CCPP values in the range of 4 to 10 are generally considered acceptable for water system operations.

4. PROPOSED PILOT PROJECT FOR THE EVAULATION OF COPPER REDUCTION

With the results of water quality parameter analysis, it is evident that a significant risk to the oversaturation of calcium carbonate is posed with any measures designed to increase pH or dissolved inorganic carbon. Per EPA OCCT guidance manual flowchart 2a the addition of orthophosphate has been selected for copper reduction. The modification will inhibit both uniform and galvanic corrosion mechanisms through the formation of a thin phosphate-based passivation layer on interior pipe and fitting surfaces within the distribution system. The OCCT identifies orthophosphate (typically as phosphoric acid) as an approach with a strong record of performance in reducing copper release in systems with lead and copper containing distribution infrastructure. The addition will not affect calcium carbonate precipitation potential in the water; however, it should be recognized that the dosing of orthophosphate will likely result in a small increase in measurable phosphate concentrations at the Town of Telluride WWTP. Further, it is recognized that the phosphate limit in the surface water discharge permit for the WWTP will likely be reduced in 2028 as CDPHE phases in lower nutrient limits under Regulation No. 31.17. The orthophosphate/polyphosphate blend will be introduced into the Jan Joaquin transmission line. This line supplies approximately two-thirds of the District distribution system.

5. CONCLUSIONS

The Town of Mountain Village desires to decrease the concentrations of copper being transmitted from the distribution system into the town drinking water supply. Currently copper loading from the District water system comprises a portion of the total copper loading to the Town of Telluride WWTP, which is challenged to meet their copper effluent permit limit. Mildly corrosive water and copper containing infrastructure in both the Mountain Village and the Town of Telluride influent flows to the WWTP are believed to be substantial contributors to the copper loading. The proposed pilot project will assess the performance of the addition of an orthophosphate/polyphosphate blend to mitigate the slightly corrosive effect of the districts treated water on copper containing distribution infrastructure.